

(RESEARCH ARTICLE)



Comparative study of the need for re-intervention after chest tube remove in two groups with and without chest x-ray in patients admitted into Razi and Poursina hospital in Rasht city

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Abstract

Introduction: The most common types of injuries following blunt or sharp trauma of lungs and the pleural space are pneumothorax, hemothorax and hemopneumothorax, which in most cases are resolved through supportive care and thoracostomy (use of chest tubes). Removal of the CT (chest tube) can result in complication such as pneumothorax and accumulation of fluid in the pleural space. Despite the lack of a standard guideline regarding the management of patients post CT removal, it is advised to procure a CXR as a means of a conservative approach. However, most of the findings acquired from the post CT removal CXR are not clinically significant and in the case of patients requiring intervention, there are almost always clinical signs and symptoms present. Considering the prior statements, the lack of a standard guideline even in the general and thoracic surgery references, show cases the importance of this study. This study is set upon proving that, the omission of post CT removal CXR in asymptomatic patients will not have an impact on the clinical outcome of the case and will reduce the costs as well as the patients' exposure to radiation and hospital stay.

Methods: This study is designed as cross-sectional study with a sample size of 200 patients who were hospitalized for CT insertion in the Surgery clinic of Razi and Poursina Hospitals in Rasht between 21/4/2019 and 20/4/2020 and matched our entry criteria. The patients were divided into 2 groups of 100, with one group being monitored without CXR and the other with the use of CXR. Some forms were designed as checklists for the task of data collection. The data analysis was done through Fisher's exact test, Chi square test and Mann Whitney U test. In addition, the Significance level was set at 0.05 (p value \leq 0.05).

Result: Out of the 200 patients included in our study, 120 were male (60%) and the rest (40%) were female. The most common underlying disease in both groups (with and without CXR) of our study was Hip fracture. In both groups, The most frequent reason for CT insertion was pleural effusion (36% and 43% in with CXR and without CXR groups respectively), but the difference between the 2 groups was not statistically significant (p = 0.597). In most of the cases, 1 CT was inserted and there was no statistically significant difference between the 2 groups. The difference between the 2 groups regarding the need for intervention (11 cases in the CXR group and 6 cases in the Non CXR group) was also statistically insignificant. The duration of hospital stay did not show a statistically significant difference between the 2 groups (p = 0.644).

Conclusion: Our study suggests that whether a post CT removal CXR is obtained or not, will not make a statistically significant difference in the number of interventions, the cause of intervention, and the number of inserted CTs and the

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duration of hospital stay. Therefore, it can be suggested that the need for reintervention in post CT removal patients can be determined through clinical signs, symptoms and the surgeon's judgment, without the need for a routine CXR.

Keywords: General Surgery; Thoracostomy; CXR; Patient management

1. Introduction

The prevalent form of chest trauma with blunt mechanisms is such as vehicle accidents, penetrating injuries like a stab wound, and their entering into the lung's internal space or pleural space. Chest trauma divides into two subcategories as blunt and penetrating trauma but specifically, they divide into 7 categories including chest wall injuries, pulmonary (including lung and pleural space), respiration tract, cardiac, thoraci aorta, esophagus, and diaphragm. In this categorization, injuries with blunt trauma or penetrating, pulmonary injuries and pleural space areas pneumothorax, hemothorax, or hemopneumothorax that few of these cases need surgery; because more than 81% of these injuries will be cured with supportive therapy or chest tube insertion (thoracostomy chest tube) [1, 2].

Hemothorax is blood aggregation in the pleural space and it could be the result of blunt or penetrating chest trauma. Most of the hemothorax cases make due to ribs fracture which are because of blunt trauma [3]. Mostly low volume hemothorax in CT scan doesn't need an especial action, but in hemothorax with high volume, chest tube insertion is the first step [4, 5]. Pneumothorax is air aggregation in the pleural space. All of the silicosis and bilateral pneumothoraxes and most of the simple pneumothoraxes need air drain with a chest tube [6]. About pneumothorax, in patients who had multiple injuries or need long time anesthesia (respiratory support with the system) or those who are transporting in a long direction to another hospital, chest tube insertion is a logical action [7]. Drainage pleural space by a chest tube is the most common step in chest trauma surgery that usually is a certain treatment [8]. The chest tube uses for drainage of the contents of the pleural space, including air, blood, or other fluids like shale and filth. The insertion of the chest tube is useful for prevention in the pleural aggregation after thoracotomy or prevention from the creation of tension pneumothorax in patients who are under ventilation with limited pneumothorax and ribs fracture. After insertion of the chest tube and attention to therapeutic goal, in case of lack of air licking or aggregation of fluid at the least possible amount, we can bring the chest tube out. Bringing the tube out can be done at the end of exhalation or the peak of a deep inhalation. This point for the prevention of entering the air, during pulling the tube into the chest, is necessary [9, 10]. In expert surgery texts, taking chest x-ray (CXR) recommended as a general and protective operation, after pulling the tube into the chest [4, 5].

Despite common clinical usage of CXR after pulling the chest tube, still, there hasn't done any research to prove the benefit of this act, but it is interesting that after some limited research about the patients and after their general surgery, heart surgery, and pediatric and neonatal surgery, found out that doing CXR after the chest tube has brought out, doesn't have any benefit in checking the patient in terms of clinical signs [11, 12].

The lack of existence of a standard instruction correlates to the patient's operation after bringing the chest tube out, even in general and chest surgery sources are the reason for the necessity of the current study. As a point, one of the differences between this study and previous studies is that we just studied those cases who were without any signs after bringing the chest tube out and had not respiratory and hemodynamics changes. Ergo, this study is going to prove that the removal of optional CRX after bringing the chest tube out in patients without any signs, doesn't have anything to do with their conditions and causes the patients to be less touched by ray and noticeable payments decrease. Due to what was said, the current study has done in Razi hospital (in Rasht, Iran), with this purpose -the necessity of CXR- after bringing the chest tube out. This operational study, in case of confirmation, can be replaced with tasty-actions in hospital sections, as an executive protocol.

2. Procedure

This study has done on the patients who were hospitalized for chest tube insertion at Razi and PoorSina hospital in Rasht city in 2019. So, patients after bringing the chest tube out got checked in terms of entering, lack of entering, and exiting. Then the qualified ones accidentally go in one of the comparative categories (with or without CXR).

2.1. Conditions require to being qualified for the study

- Have an agreement for entering into the study
- Being less than 65 years old
- Ability to breathe by themselves without any need for respiratory support
- Patients without heart, renal, and thyroid disease experience

- Patients who have no signs after pulling the chest tube

2.2. Conditions for refuse to enter into the study

- Patients who passed away before taking the chest tube
- Patients who had some signs after taking the chest tube (asthma – tachypnea)
- Each type of needs to respiratory support and dependency to the ventilator during hospitalization.

3. Way of implementation of the project

The hospitalized patients, after that their signs such as asthma, tachypnea, lack of having leakage, and those who have less than 150cc a day tube discharging went away, became a candidate for taking the chest tube out. Taking the chest tube out has done by a resident surgery after a deep exhalation and making a Valsalva maneuver (hard pushing). Then the patient has taken care of the resident and nursing team for four hours and clinical signs and evidence and amount of arterial oxygen during this time recorded. In case of existence of any clinical signs and patient complaining during this four hour, quickly a CXR has done on the patient and based on clinical signs and CXR results on patients we decided to come in the situation and took care of it that included: go on reinsertion of the chest tube, checking the patient out, and taking the CXR serial. If the patients during these four hours, had no clinical signs such as asthma, tachypnea, and chest-wall pain and they were qualified from other sides for entering into the study, accidentally divided into two categories as with or without CXR. In the with-CXR category, after taking CXR, based on the results, we immediately decided to patient discharge, checking the patient out or reengaging with him. Reengaging with him means doing pleural tap or chest tube insertion (thoracostomy). In the without-CXR category, the patients watched out for 2-6 hours for considering the numbered signs that we just said and then they released.

4. Data collection method

Patients' information such as age, gender, other disease experiences, the time of having the disease, the reason of chest tube insertion, number of chest tubes inserted, the direction of tube insertion and duration of treatment with that, duration of hospitalization in hospital, need to reengaging, the reason of tube reinsertion, and need to retake the CXR was already prepared in the checklist and collected from all patients. In the end, all of the collected data from CXR and clinical achievements recorded and generally compared. After collecting, the information entered into SPSS software, version.22

5. Results

Overall, 200 patients hospitalized at the surgery sections in Razi and PoorSina hospitals in Rasht city, for chest tube insertion that compared in two categories as with (category 1) and without (category 2) CXR. Patients' age average in the study was $48/9 \pm 28/52$, with 50/54 middle age and from 30 to 64 age range. The first category's patients' middle-age was higher than the other category, but this difference statistically didn't mean anything ($p=0/0820$). The high percentage of patients in the study were women (60%) and in terms of sexuality, there wasn't much statistical difference between those two categories ($p=0/083$).

Based on our results, evaluation in terms of the time of having the disease ($p=0/312$) and types of other disease experiences ($p=0/687$), there wasn't any logical difference between the two categories. (table1).

Based on the reason for chest tube insertion too ($p=0/597$).

In most cases, just one chest tube was inserted and in terms of numbers of tubes inserted there wasn't any logical difference between two categories ($p=0/732$). In terms of the direction of chest tube insertion ($p=0/171$) and duration of treatment with chest tube ($p=0/587$), there wasn't a statistically meaningful difference between two categories (table2).

Reasons for need to reengaging, include 13 cases dyspnea and 4 cases tachypnea and dyspnea and in these terms, there wasn't statistically meaningful difference between two categories. Types of reengaging, in 8 cases were about Posterolateral Thoracotomy and 9 cases were about tube reinsertion and there wasn't statistically meaningful difference between two categories.

In terms of duration of hospitalization in the hospital, there wasn't a statistically meaningful difference between the two categories too (table3).

Table 1 Demographic and basic information in two categories; with and without CXR

p-value	The category without CXR (n=100)	The category with CXR (n=100)	Variable	
0/820	51/87±10/17 54/00 (30/00-64/00)	52/68±8/76 (32/00-64/00) 55/00	Age (years), average ± medium standard deviation (maximum - minimum)	
0/083	66 (66/0)	54 (54/0)	male	Gender, number (%)
	34 (34/0)	46 (46/0)	female	
0/312	64 (64/0)	63 (63/0)	<1	The time having the disease (years), number (%)
	19 (19/0)	13 (13/0)	1-5	
	17 (17/0)	24 (24/0)	>5	
0/687	15 (15/0)	16 (16/0)	COPD	The other disease experiences
	6 (6/0)	10 (10/0)	diabetes mellitus	
	17 (17/0)	18 (18/0)	Hip fracture	
	9 (9/0)	8 (8/0)	Rib fracture	
	11 (11/0)	8 (8/0)	Limb fracture	
	6 (6/0)	9 (9/0)	Lymphoma	
	10 (10/0)	7 (7/0)	Lung Small cell carcinoma	
	8 (8/0)	12 (12/0)	Breast cancer	
	9 (9/0)	3 (3/0)	Asthma	
9 (9/0)	9 (9/0)	Lung Adenocarcinoma		

Table 2 Information of inserted chest tube in two categories; with and without CXR

p-value	The category without CXR	The category with CXR	Variable	
0/597	28 (28/0)	31 (31/0)	pneumothorax	The reason of chest tube insertion, number (%)
	29 (29/0)	33 (33/0)	homothorax	
	43 (43/0)	36 (36/0)	pleural effusion	
0/732	83 (83/0)	78 (78/0)	1	The number of inserted chest tube, number (%)
	16 (16/0)	21 (21/0)	2	
	1 (1/0)	1 (1/0)	3	
0/171	37 (37/0)	46 (46/0)	right	The side of chest tube insertion, number (%)
	46 (46/0)	33 (33/0)	left	
	17 (17/0)	21 (21/0)	Both sides	
0/587	4/93±3/71 4/00 (2/00-25/00)	4/98±3/16 4/00 (3/00-20/00)	Duration of treatment with chest tube (day), average ± medium standard deviation (maximum - minimum)	

Table 3 Situation in results of studying in two categories; with and without CXR

p-value	The category without CXR	The category with CXR	Variable	
0/086	88 (88/0)	79 (79/0)	no	Re-CXR for determining to need to reengage, number (%)
	12 (12/0)	21 (21/0)	yes	
0/205	94 (94/0)	89 (89/0)	no	Need to reengaging, number (%)
	6 (6/0)	11 (11/0)	yes	
>0/999	5 (83/3)	8 (72/7)	dyspnea	The reason of reengaging, number (%)
	1 (16/7)	3 (27/3)	Tachypnea+dyspnea	
>0/999	3 (50/0)	5 (45/5)	Posterolateral Thoracotomy	Type of reengaging, number (%)
	3 (50/0)	6 (54/5)	Tube reinsertion	
0/644	7/41±5/32 6/00 (4/00-35/00)	7/64±4/89 (4/00-28/00) 6/00	Duration of hospitalization in hospital (day), average±medium standard deviation (maximum - minimum)	

6. Discussion and deduction

The insertion of a chest tube is for controlling air, fluid, or blood discharge from pleura space. Routine CXR, after taking the chest tube, in many institutions is as standard care [10]. The time of taking the chest tube usually depends on the clarity of hemothorax, pneumothorax, or specified decrease in efficiency [11]. It has been determined that repeated pneumothorax or refilling of pleura space from fluid, may occur after taking the chest tube and seems that the controlling CXR that does after taking chest tube, confirms that the pleura space didn't refill [11-15].

The result of routine CXR in current studies didn't change the clinical management. Six patients from category1 and three patients from category2 have clinical signs and symptoms (like decreasing of oxygen saturation, dyspnea, and decreasing of respiratory sound) that caused more considering and reinsertion of the chest tube. For five remained patients in category1 and three remained patients in category2, posterolateral thoracotomy happened. In Cunningham research, the two of remained patients from category1 didn't have clinical signs and symptoms and reinsertion of the chest tube has done in terms of CXR information that it could have been necessary or unnecessary. Our discoveries proved that the result of CXR didn't help at making decisions and in fact, the combination of clinical signs and clinical judgment caused to re-engaging [11, 16, and 17]. These achievements prove that may be using CXR just has benefits for those patients who got signs after taking the chest tube out. Although, patients should care for a time till to be sure of preventing indications of reinsertion of the chest tube. due to all patients who needed reinsertion, got signs after 24 hours, we recommend that the patients be cared about 12-24 hours before release, although in our medical centers' protocol, taking the CXR has arranged in four hours after taking the chest tube out. If there is a need to release before this time or something is going on that place the patients in a dangerous situation, the surgeon better to do CXR before release.

So far a little different with this study, the writers of one report which is related to patients who have heart surgery and including taking out the chest tube, deduced that CXR just should be done when the patient has respiratory suffering or a hemodynamics instability, after taking the chest tube [14].

Some complications could be found after taking out the chest tube; such as pneumothorax, bleeding, and infection. In our study, the only complication that discovered, it needed to reinsertion of the chest tube.

In the current study, no noticeable statistical difference discovered during hospitalization in the hospital or the time of chest tube remaining. Another study was the same too [15]. These are against other studies that report doing the CXR routine after taking out the chest tube as a factor that increases the duration of hospitalization in the hospital. Probably, the lack of difference in duration of hospitalization in our study is because of that the patients who had done CXR before taking out the chest tube, the CXR had done for them four hours after taking out the chest tube. Another reportable point

is this that the studies relate increasing to be touched by radiation and the hospital payments to doing CXR after taking out the chest tube [6 and 11].

Due to the conclusions of our studies, we can say that the results that gain from CXR after taking out the chest tube, haven't much influence in patients managing. Also in our studies, conclusions discovered that taking a routine CXR hasn't a meaningful relation with needing reinsertion of the chest tube. In our and some other studies discovered that the duration of hospitalization of patients in the hospital also hasn't a meaningful relationship with taking CXR. Overall, our study discovered that whether in taking CXR or don't take it, after taking out the chest tube, in terms of increasing the need for reengaging, the numbers of improvised chest tubes, and the duration of hospitalization in hospitals hadn't a meaningful statistical difference. Ergo we can say that need to reengaging with patients after taking out their chest tubes, mostly is based on clinical signs and symptoms, and taking routine CXR in all cases aren't necessary. In case of removing routine CXR after taking out the chest tube, we can decrease the payments which the patient and the hospital should pay and also complications of radiation on patients.

7. Conclusion

We can say that the results that gain from CXR after removal of chest tube, haven't much influence in patients managing. Also in our studies, conclusions discovered that taking a routine CXR hasn't a meaningful relation with needing reinsertion of the chest tube. In our and some other studies discovered that the duration of hospitalization of patients in the hospital also hasn't a meaningful relationship with taking CXR. Overall, our study discovered that whether in taking CXR or don't take it, after taking out the chest tube, in terms of increasing the need for reengaging, the numbers of improvised chest tubes, and the duration of hospitalization in hospitals hadn't a meaningful statistical difference. Ergo we can say that need to reengaging with patients after taking out their chest tubes, mostly is based on clinical signs and symptoms, and taking routine CXR in all cases aren't necessary. In case of removing routine CXR after taking out the chest tube, we can decrease the payments which the patient and the hospital should pay and also complications of radiation on patients.

Compliance with ethical standards

Disclosure of conflict of interest

None.

Statement of informed consent

A written informed consent was obtained from the patient for publication of identifying data.

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